

IN THE CLAIMS

Please amend the claims as follows:

Claim 1 (Currently Amended): An ultrasonic diagnostic apparatus for scanning a subject to be examined with an ultrasonic pulse, the apparatus comprising:

transmitting means for transmitting the ultrasonic pulse a plurality of times along each scanning line ~~set to~~ so as to scan during each time of scanning a region ~~to be scanned~~ in the subject ~~in order to produce a single image of the region~~, ~~[[a]] transmission characteristic characteristics of [[the]] ultrasonic [[pulse]] pulses transmitted every time the ultrasonic pulse is transmitted~~ along each scanning line ~~for producing the image~~ during each time of scanning of the region being ~~different~~ changed from one another;

receiving means for receiving an ultrasonic echo signal ~~returned when the~~ of each ultrasonic pulse ~~[[is]]~~ reflected or scattered in the subject~~[[,]]~~ and acquiring an electrical reception signal ~~that corresponds~~ corresponding to ~~[[the]]~~ each ultrasonic echo signal;

filter means for applying filtering processing to each reception signal acquired by the receiving means, ~~a characteristic~~ characteristics of the filtering processing applied to each of the reception signals acquired along each scanning line during each time of scanning of the region being ~~different~~ changed from one another and being respectively related in frequency domains to the transmission characteristics of the ultrasonic pulses transmitted along each scanning line during each time of scanning of the region;

synthesizing means for synthesizing the plurality of reception signals, scanning line by scanning line, filtering-processed by the filter means;

producing means for producing image data of the region using the reception signals synthesized by the synthesizing means; and

display means for displaying the image data produced by the producing means.

Claim 2 (Currently Amended): The ultrasonic diagnostic apparatus as claimed in claim 22, wherein the transmitting unit is configured to change a center frequency of the transmission characteristic of each ultrasonic pulse ~~every time the ultrasonic pulse is~~ transmitted along each scanning line ~~in order to produce the image~~ during each time of scanning of the region.

Claim 3 (Currently Amended): The ultrasonic diagnostic apparatus as claimed in claim 22, wherein the transmitting unit is configured to transmit the ultrasonic pulse of which frequency bandwidth is ~~narrow~~ limited to an extent ~~such~~ that a signal component of the reception signal corresponding to a harmonic component of the ultrasonic pulse that has been transmitted is separable from a signal component of the reception signal corresponding to a fundamental component of the ultrasonic pulse that has been transmitted.

Claim 4 (Currently Amended): The ultrasonic diagnostic apparatus as claimed in claim 22, wherein the filter is configured to sample, every time the ultrasonic pulse is transmitted, from the reception signal, a signal component corresponding to a harmonic component of the ultrasonic pulse that has been transmitted and the synthesizing unit is configured to mutually synthesize the harmonic components filtered by the filter in response to transmitting the ultrasonic pulse along each scanning line ~~for producing the image~~ during each time of scanning of the region.

Claim 5 (Currently Amended): The ultrasonic diagnostic apparatus as claimed in claim 4, wherein the signal component corresponding to the harmonic component, which is synthesized by the synthesizing unit, is broader in a bandwidth than the harmonic component

~~obtained by one time of both the transmission/reception and the filtering processing~~ from the filter.

Claim 6 (Previously Presented): The ultrasonic diagnostic apparatus as claimed in claim 4, wherein the harmonic component is a signal component that corresponds to a sub harmonic component of the ultrasonic pulse, the sub harmonic component being generated due to a non linear behavior of an ultrasonic contrast medium administered into the subject.

Claim 7 (Currently Amended): The ultrasonic diagnostic apparatus as claimed in claim 4, wherein the filter is configured to change the characteristic of the filtering processing according to a depth in a direction of each scanning line ~~direction~~, the characteristic of the filtering processing being determined so that a predetermined amount of a signal component corresponding to a fundamental component of the ultrasonic pulse is positively left in a ~~filtered~~ signal filtered by the filter.

Claim 8 (Currently Amended): The ultrasonic diagnostic apparatus as claimed in claim 22, wherein the synthesizing unit is configured to mutually add the plurality of reception signals filtering processed by the filter ~~correspondingly~~ corresponding to each scanning line during each time of scanning of the region.

Claim 9 (Currently Amended): The ultrasonic diagnostic apparatus as claimed in claim 22, further comprising:

a changing unit configured to change, every time the ultrasonic pulse is ~~repeatedly~~ transmitted a plurality of times along each scanning line ~~a plurality of times~~ during each time

of scanning of the region, at least one of parameters including a center frequency and a frequency bandwidth of the ultrasonic pulse, an amplitude of the ultrasonic pulse, an aperture for transmitting the ultrasonic pulse, a focus obtained when the ultrasonic pulse is beam formed, a receiving gain for the reception signal, and an addition coefficient for obtaining the reception signal.

Claim 10 (Currently Amended): The ultrasonic diagnostic apparatus as claimed in claim 22, wherein the transmitting unit is configured to transmit the ultrasonic pulse having a frequency bandwidth at in which both a first signal component of the reception signal corresponding to a harmonic component of the ultrasonic pulse and a second signal component of the reception signal corresponding to a fundamental component of the ultrasonic pulse are partially overlapped on each other with regard to spectra of the first and second signal components, and

the filter is configured to extract, from the reception signal, every time of transmitting the ultrasonic pulse along each scanning line during each time of scanning of the region, a signal component having a frequency range falling in into a frequency range of the harmonic component, but being outside an overlapped frequency range on the fundamental component.

Claim 11 (Currently Amended): The ultrasonic diagnostic apparatus as claimed in claim 22, wherein the transmitting unit is configured to change both ~~of the~~ a number of times of ~~transmission of transmitting~~ the ultrasonic pulse ~~to be transmitted~~ along each scanning line during each time of scanning of the region and a center frequency of the ultrasonic pulse to be transmitted ~~each time~~ along each scanning line during each time of scanning of the region so that physiological attenuation occurring when the ultrasonic pulse and the ultrasonic echo

signal propagate through the subject is corrected in the reception signal synthesized by the synthesizing unit.

Claim 12 (Currently Amended): An ultrasonic diagnostic apparatus for scanning a subject to be examined with an ultrasonic pulse, thereby acquiring a harmonic image, said apparatus comprising:

a transmitting unit configured to transmit the ultrasonic pulse a plurality of times along each scanning line ~~set to~~ so as to scan during each time of scanning a region ~~to be scanned~~ in the subject ~~in order to produce a single image of the region~~, the ultrasonic pulse having a ~~narrow bandwidth~~ first bandwidth with a spectrum characteristic set to such an extent that a signal component corresponding to a harmonic component of the ultrasonic pulse is separable from a signal component corresponding to a fundamental component of the ultrasound pulse;

a receiving/processing unit configured to receive an echo signal of the ultrasonic pulse responsively to each of the plurality of times of transmission of the ultrasonic pulse along each scanning line ~~[[,]]~~ during each time of scanning of the region and processing to process the echo signal received ~~each time~~ into a harmonic signal having a ~~broader bandwidth~~ second bandwidth with a spectrum characteristic broader than the first bandwidth of the transmitted ultrasonic pulse; and

an image producing unit configured to produce a harmonic image from the harmonic signal.

Claim 13 (Currently Amended): An ultrasonic imaging method in which a subject to be examined is scanned by an ultrasonic pulse transmitted ~~[[,]]~~ and an electrical reception

signal that corresponds to an ultrasonic echo signal ~~returned when~~ of the ultrasonic pulse is reflected or scattered in the subject is acquired, ~~and an image of a region scanned in the subject is obtained from the reception signal~~, said method comprising the steps of:

executing transmission of the ultrasonic pulse, reception of the echo signal, and acquisition of the reception signal, each of the transmission and the reception being carried out a plurality of times along each scanning line ~~forming to scan during each time of scanning the region to be scanned in order to produce a single image of the region~~ and transmission characteristics of the ultrasonic pulses transmitted along each scanning line during each time of scanning of the region being changed from one another;

applying filtering processing to each reception signal acquired, ~~a characteristic~~ characteristics of the filtering processing applied to each of the reception signals acquired along each scanning line during each time of scanning of the region being ~~different~~ changed from one another and being respectively related in frequency domains to the transmission characteristics of the ultrasonic pulses transmitted along each scanning line during each time of scanning of the region;

synthesizing the plurality of processed reception signals with each other, scanning line by scanning line;

producing image data of the region scanned by using the synthesized reception signals; and

displaying an image based on the produced image data.

Claim 14 (Currently Amended): The ultrasonic imaging method as claimed in claim 13, wherein the transmitted ultrasonic pulse is ~~different~~ changed from each other with respect to a center frequency thereof every time the ultrasonic pulse is transmitted along each

scanning line during each time of scanning of the region.

Claim 15 (Currently Amended): The ultrasonic imaging method as claimed in claim 13, wherein the transmitted ultrasonic pulse has a ~~narrow~~ limited frequency bandwidth set to such an extent that a signal component of the reception signal corresponding to a harmonic component of the ultrasonic pulse is separable from a signal component of the reception signal corresponding to a fundamental component of the ultrasonic pulse.

Claim 16 (Currently Amended): The ultrasonic diagnostic apparatus as claimed in claim 13, wherein the filtering processing is set to a process for sampling, every time the ultrasonic pulse is transmitted along each scanning line during each time of scanning of the region, from the reception signal, a signal component that corresponds to a harmonic component of the ultrasonic pulse.

Claim 17 (Currently Amended): The ultrasonic diagnostic apparatus as claimed in claim 16, wherein the signal component corresponding to the harmonic component, which is synthesized at the synthesizing step is broader in a bandwidth than the harmonic component obtained ~~by one time of both the transmission/reception and~~ from the filtering processing.

Claim 18 (Previously Presented): The ultrasonic diagnostic apparatus as claimed in claim 15, wherein the harmonic component corresponds to a second harmonic component of the ultrasonic pulse generated due to either a non linearity of physiological tissues of the subject or a non linear behavior of an ultrasonic contrast medium administrated into the subject.

Claim 19 (Currently Amended): The ultrasonic diagnostic method apparatus as claimed in claim 13, further comprising the step of changing, every time the ultrasonic pulse is ~~repeatedly~~ transmitted a plurality of times along each scanning line ~~a plurality of times~~ during each time of scanning of the region, at least one of parameters including a center frequency and a frequency bandwidth of the ultrasonic pulse; an amplitude of the ultrasonic pulse; an aperture for transmitting the ultrasonic pulse; a focus obtained when the ultrasonic pulse is beam formed; a receiving gain for the reception signal; and an addition coefficient for obtaining the reception signal.

Claim 20 (Currently Amended): An ultrasonic diagnostic apparatus for scanning a subject to be examined with an ultrasonic pulse in order to acquire a harmonic image of the subject, said apparatus comprising:

a transmitting unit configured to transmit the ultrasonic pulse a plurality of times along each scanning line ~~set to~~ so as to scan during each time of scanning a region ~~to be scanned~~ in the subject ~~in order to produce a single image of the region~~, the plurality of times of the ultrasonic pulses to be transmitted including two types of ~~[[the]]~~ ultrasonic pulses of which signal polarities are opposite to each other, each type of the ultrasonic pulse being ~~further~~ transmitted a plurality of times, ~~[[a]]~~ and transmission characteristic characteristics of the ultrasound ~~pulse belonging to each type~~ pulses being ~~different~~ changed one from the other;

a receiving unit configured to receive an electrical reception signal that corresponds to an ultrasonic echo signal returned from the subject every time of transmission of the ultrasonic pulse;



a synthesizing unit configured to mutually add, between the two types of transmission, the reception signals to produce a plurality of harmonic components depending on ~~the restrictive~~ respective transmission characteristics and to mutually synthesize, every ~~type~~ time of ~~a~~ transmission, the plurality of harmonic components to broaden a bandwidth of the harmonic component relevant to a fundamental component of the ultrasonic pulse; and

an image producing unit configured to produce the harmonic image from the harmonic component of which bandwidth is broadened by the synthesizing unit.

Claim 21 (Canceled).

Claim 22 (Currently Amended): An ultrasonic diagnostic apparatus for scanning a subject to be examined with an ultrasonic pulse, the apparatus comprising:

a transmitting unit configured to transmit the ultrasonic pulse a plurality of times along each scanning line ~~set to~~ so as to scan during each time of scanning a region ~~to be scanned~~ in the subject ~~to produce a single image of the region~~, ~~[[a]]~~ transmission ~~characteristic~~ characteristics of ~~[[the]]~~ ultrasonic ~~pulse~~ pulses transmitted ~~every time the ultrasonic pulse is transmitted~~ along each scanning line ~~for producing the image during each time of scanning of the region~~ being ~~different~~ changed from one another;

a receiving unit configured to receive an ultrasonic echo signal ~~returned from the region of~~ each ultrasonic pulse returned from the subject and to acquire an electrical reception signal corresponding to ~~[[the]]~~ each ultrasonic echo signal;

a filter configured to apply filtering processing to each reception signal acquired by the receiving unit, ~~a characteristic~~ characteristics of the filtering processing applied to each of the reception signals acquired along each scanning line during each time of scanning of the

region being different changed from one another and being respectively related in frequency domains to the transmission characteristics of the ultrasonic pulses transmitted along each scanning line during each time of scanning of the region; and

a synthesizing unit configured to synthesize the plurality of reception signals, scanning line by scanning line, filtering-processed by the filter.